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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/905,172	07/13/2001	David S. Mui	004227 USA 02/ETCH/SILICO	2748

32588 7590 11/14/2003

APPLIED MATERIALS, INC.
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EXAMINER
DEO, DUY VU NGUYEN

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 11/14/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/905,172	MUI ET AL.	
	Examin r	Art Unit	
	DuyVu n Deo	1765	

-- The MAILING DATE of this communication appears on the cover she t with the correspondence address --

P riod for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 September 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *8-40* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *8-40* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 8-13, 15-21, 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang (US 6,171,940) and Hasegawa et al. (US 6,452,274).

Huang describes a method for forming a semiconductor device comprising: providing a substrate structure; forming an organic layer with low dielectric constant over the substrate; depositing a dielectric layer, SiON, over the organic layer; providing a patterned photoresist (claimed organic photoresist: please see cited art below) over the dielectric layer; etching the dielectric layer with dry etch (claimed first plasma etching) until apertures are formed in the dielectric layer; etching the organic layer using an anisotropic etching (claimed second plasma etching) until apertures are formed in the organic layer (col. 2, line 47-col. 3, line 17). Unlike claimed invention, Huang doesn't describe the organic low dielectric layer is formed by CVD and comprising carbon and hydrogen. Hasegawa describes a method for forming an organic low dielectric layer by PECVD and using material such as fluorinated ethylene propylene. This would form an organic layer comprising carbon and hydrogen (col. 3, line 20, 48; col. 8, line 65-col. 9, line 11). It would have been obvious for one skill in the art to form the organic low dielectric layer in light of Hasegawa because Hasegawa further teaches method that is silent in Huang to form an organic low dielectric layer with a reasonable expectation of success.

Referring to claim 13, using propylene gas would be obvious since Hasegawa also describe using PECVD system for deposition (col. 9, line 8).

Referring to claim 15, 16, Hasegawa describes the etching gas for the organic layer comprising O2 (col. 10, line 16, 17).

Referring to claim 21, Huang describes the substrate structure being etched comprising polysilicon (claimed silicon layer).

Referring to claim 18, Huang further describes removing the organic layer after the substrate structure is etched (col. 3, line 39-44). Referring to claims 19 and 28, Hasegawa further teaches gases that remove the organic layer comprises O2 (col. 10, line 16, 17).

Referring to claims 10 and 11, Hasegawa describes etching the dielectric layer, including silicon oxide, silicon oxynitride, using fluorocarbon-containing species (col. 9, line 59-col. 10, line 25).

3. Claims 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang and Hasegawa as applied to claim 21 above, and further in view of Tsai et al. (US 6,083,815).

Referring to claim 22-24, Huang describes the substrate structure comprising a silicon substrate (claimed single crystal silicon), an oxide layer over the silicon substrate, a doped polysilicon over the oxide layer (col. 2,line 47-60). Prior art of Huang and Hasegawa doesn't describe the substrate further comprising a native oxide layer over the doped polysilicon layer and etching the native oxide and the doped polysilicon layer using 2 etching plasma that comprises a halogen containing species. Tsai describes a same method for etching a substrate to form a gate stack in which the doped polysilicon layer includes a native oxide and etching the native oxide and the doped polysilicon layer using 2 etching plasma processes that comprise

halogen containing species to form a gate stack (col. 6, line 3-15, col. 7, line 1-6, 38-52). It would have been obvious for one skill in the art at the time of the invention to etch the polysilicon in light of Tsai further describes specific gases to etch the polysilicon and its native oxide with a reasonable expectation of success.

4. Claims 25, 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang and Hasegawa as applied to claim 21 above, and further in view of Lou (US 6,200,881).

Referring to claims 25 and 26, applied prior art of Huang and Hasegawa doesn't describe the substrate further comprising a single crystal silicon layer (will be referred as silicon layer), an oxide layer over the silicon layer, and a silicon nitride layer over the oxide layer wherein the silicon, oxide, and nitride layer are etched by one or more plasma etching steps comprising oxygen and halogen containing species. Lou describes a method for etching a substrate which comprising a silicon layer, an oxide layer over the silicon layer, and a silicon nitride layer over the oxide layer, wherein the silicon, oxide, and nitride layer are etched by one or more plasma etching steps comprising oxygen and halogen containing species (col. 3, line 50-col. 4, line 15). It would have been obvious for one skill in the art to modify the substrate of combined method above in light of Lou because depending on the type of substrate structure being made, shallow trench isolation can be formed by Lou's method.

5. Claims 30, 31, 33, 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang and Hasegawa, and further in view of Chapman (US 5,976,769).

Applied prior art of Huang and Hasegawa doesn't describe etching portions of the organic layer to reduce the width of the organic layer. However, Huang teaches of reducing the photoresist width so that the width of the organic layer can also be smaller (col. 3, line 7-15).

Chapman describes a method for providing sublithographic patterns wherein the exposed sidewalls of the organic layer is etched such that the width of the organic layer is reduced at the substrate using etching technique including plasma etch (figure 8a-8d; col. 5, line 15-col. 6, line 7). It would have been obvious for one skill in the art at the time of the invention to modify applied prior art method in light of Chapman's method of etching the exposed sidewalls of the organic layer because Chapman shows that it is also provide the same result as reducing the photoresist (third embodiment) and it would provides a smaller linewidth than using conventional lithographic process and a smaller linewidth would be desired in fabrication of semiconductor circuits with high device density according to Chapman (col. 1, line 10-40).

6. Claims 14, 32, 35-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang/Hasegawa or Huang/Hasegawa/Chapman as applied to claims 8, 17, 27, 30 above, and further in view of Cheng et al. (US 5,873,984).

Unlike claimed invention, applied prior art of Huang/Hasegawa or Huang/Hasegawa/Chapman doesn't describe the organic layer has 70-80 % of carbon, 10-20% hydrogen, and 5-15 % of nitrogen. Cheng describes a method for forming an organic layer (amorphous carbon layer) having carbon, hydrogen, and nitrogen, where in the ratio of nitrogen and hydrogen is from 0.5-1.0 (col. 2, line 26, 27, col. 5, line 5, 6). It would have been obvious to one skill in the art in light of Cheng to add nitrogen because Cheng teaches that the resultant nitrogen and hydrogen improved characteristics in both mechanical property and tribological performance of the organic layer (col. 2, line 18-35). Furthermore he also the teaches to determine the ratio of the chemicals in the organic layer through routine experimentation because he shows that the chemical concentration is result-effective variable as he tests different ratios of

the nitrogen and hydrogen through test runs so that optimum ratio can be obtain to provide optimum result (col. 5, line 3-6) wherein the nitrogen and hydrogen concentration are similar.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DuyVu n Deo whose telephone number is 703-305-0515.

DVD
11/5/03